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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/363,277 07/28/99 WURSTER

K GR.98P.1801.

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MMC2/0523

EXAMINER

KENNEDY, J

ART UNIT

PAPER NUMBER

2812

DATE MAILED:

05/23/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No. 09/363,277	Applicant(s) WURSTER ET AL.	
	Examiner Jennifer M. Kennedy	Art Unit 2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 February 2000.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 1-7 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 July 1999 is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- | | |
|---|--|
| 15) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 18) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 16) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 19) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 17) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>7</u> . | 20) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-7, drawn to a semiconductor device, classified in class 257 subclass 301+.
- II. Claims 8-20, drawn to a process of making a semiconductor device, classified in class 438, subclass 238+.

The inventions are distinct, each from the other because of the following reasons:

Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product as claimed can be made by a materially different process. For example, the semiconductor device can be manufactured by a diffusion process rather than an implantation, plasma doping or vapor phase deposition process as in claim 6. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Mr. Greenberg on March 30, 2001 a provisional election was made without traverse to prosecute the invention directed to

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the method, claims 8-20. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-7 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Drawings

Figures 6-12 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g).

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 8, 10, 11 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 8 recites the method of providing a buried contact and introducing a dopant into the substrate. It seems from applicant's specification that these are not two separate steps, but that in fact the buried contact is formed by introducing dopant into the substrate by a method including implantation,

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plasma doping, and vapor phase deposition. It is not clear to the examiner from the claim as it is worded that the buried contact is formed by the method of implantation, plasma doping, and vapor phase deposition. The examiner believes that as the claim is written the limitation only requires that a buried contact is formed and that dopant is introduced into the substrate by a method of implantation, plasma doping or vapor phase deposition. In which case even an ion implantation in order to form a source/drain region could be read on the present claim.

Furthermore, as best as can be understood by the examiner, the method of introducing the dopant forms the buried contact layer (250) (see specification page 50, line 13), however the limitation of introducing the dopant is done in the vicinity of the buried contact. How can the dopant that are introduced to form the buried contact be formed in the vicinity of the buried contact, if the buried contact is currently being formed?

Further claims 10, 11 and 13 are all methods of forming the buried contact, but also recite the limitations of doping through the interface of the buried contact. This is impossible since the buried contact is not yet formed until the step of doping is completed.

Claims 9, 12, 13, and 15-20 are also rejected under 35 U.S.C. 112, second paragraph, for being dependent on previously rejected claims under 35 U.S.C. 112, second paragraph.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 8, 9, 12, 13, and 15-18 are rejected under 35 U.S.C. 102(b) as being anticipated by the applicants' admitted prior art (see specification pages 1-36 and Figures 6-12).

The applicants' admitted prior art discloses the method of forming a trench capacitor including the steps of:

- providing a substrate (101);
- forming a trench (108) with a lower region and an upper region in the substrate;
- filling the lower region of the trench with a first filling material (152);
- forming an insulation collar (168) in the upper region of the trench;
- removing the first filling material from the lower region of the trench (see Figure 7c and specification page 18, line 8-10);
- lining the lower region of the trench and an inner side of the insulation collar with a dielectric layer (164) as a capacitor dielectric;
- filling the trench with a conductive second filling material (161) as a capacitor plate;
- providing a buried contact (250); and
- introducing a dopant into the substrate in a region underneath a surface of the substrate (113, 114) in a vicinity of the buried contact by at least one process selected

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from the group consisting of implantation, plasma doping, and vapor phase deposition (see specification page 26, line 12-20).

The applicants' admitted prior art also discloses the method including forming a buried plate (165) in a vicinity of the lower region of the trench as a further capacitor plate, the method of forming an tunnel layer (151) on an interface of the buried contact of oxide (see specification page 15, line 23 through page 16, line 2), and forming above the insulation collar on the conductive second filling material, with a third conductive filling material, a strap (162) to the buried contact.

Further the applicants' admitted prior art (see specification page 32-33 and Figures 11a-11c) also discloses the method including

filling the trench with a fourth filling material (210) being selectively removable with respect to the substrate, the insulation collar and the dielectric layer, after the steps of forming the insulation collar and lining the lower region of the trench and the inner side of the insulation collar with a dielectric layer;

recessing the fourth filling material, the insulation collar, and the dielectric layer for defining an interface between the buried contact and the substrate;

removing the fourth filling material; and

filling the trench with the conductive second filling material

The applicants' admitted prior art also discloses the method including widening the lower region of the trench (W2) relative to the upper region of the trench for forming a bottle shaped trench (see Figure 8) and the method of forming a buried strap in the trench (162).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over the applicants' admitted prior art (see specification pages 1-36 and Figures 6-12). The applicants' admitted prior art discloses the method substantially as claimed, but does not disclose the method of introducing a dopant includes vapor phase doping through an exposed interface of the buried contact with AsH₃ and PH₃. The examiner takes official notice of facts outside the record which are capable of instant and unquestionable demonstration as being "well-known" in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to introduce dopant into the substrate using vapor phase doping. Vapor phase doping is well known and used in the art to dope regions of the substrate. Further, AsH₃ and PH₃ are commonly used dopants during vapor phase deposition.

Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicants' admitted prior art (see specification pages 1-36 and Figures 6-12). The applicants' admitted prior art discloses the method substantially as claimed, but does not disclose the method of performing the steps of providing the buried contact and forming the tunnel layer in a single process sequence without removing the substrate from the process chamber. The examiner takes official notice of facts outside

the record which are capable of instant and unquestionable demonstration as being "well-known" in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the process steps in a single sequence without removing the substrate from the process chamber. The method of performing a sequence of steps without removing the substrate is commonly done to reduce contamination of the substrate surface.

Claims 8-13, and 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicants' admitted prior art in view of Canale et al (U.S. Patent No. 6,040,213) or Hoepfner (U.S. Patent No. 6,008,103).

The applicants' admitted prior art discloses the invention substantially as claimed, but does not disclose the method of forming a buried contact by introducing a dopant into the substrate in a region underneath a surface of the substrate in a vicinity of the buried contact by at least one process selected from the group consisting of implantation, plasma doping and vapor phase deposition, further including oblique doping and an isotropic doping.

Canale et al discloses the method of forming a buried contact by the method of oblique implantation (see Figure 5 and column 4, line 38-44). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the oblique doping method of Canale et al to form the buried contact region of the applicants' admitted prior art in order to connect the storage region to the transfer gate region.

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Hoepfner discloses the method of utilizing an isotropic process to introduce dopant into the substrate (see column 6, line 42-53). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a isotropic process such as plasma immersion ion implantation to introduce dopant into a substrate in order to create the desired doping uniformity along the surfaces of the trench interior.

Neither Canale not Hoepfner disclose the method of utilizing a screen oxide during the implantation, however the examiner takes official notice of facts outside the record which are capable of instant and unquestionable demonstration as being "well-known" in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a screen oxide during implantation. Screen oxides are well known and commonly used to prevent damage to the substrate during implantation.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Kennedy whose telephone number is (703) 308-6171. The examiner can normally be reached on Mon.-Fri. 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on (703) 308-3325. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7724 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

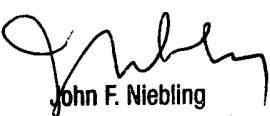
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May 16, 2001


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